

The Use of Complex Quantities in Alternating Currents: G. W. PATTERSON, University of Michigan.

Physical Research at a Mountain Observatory: G. E. HALE, Mt. Wilson Observatory.

Some Curious High-temperature Phenomena: C. E. MENDENHALL, University of Wisconsin.

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SCIENTIFIC BOOKS

The Origin of a Land Flora: A Theory based upon the Facts of Alternation. By F. O. BOWER, Sc.D., F.R.S., Regius Professor of Botany in the University of Glasgow. With numerous illustrations. 8vo, pp. xii + 727. Macmillan and Company, Limited. St. Martin's Street, London, 1908.

The author of this book is well known to American botanists as the writer of many lucid articles, and especially as the propounder of a very helpful theory as to the nature of the flower and its relation to the remainder of the sporophyte. When Professor Bower published his "theory of the strobilus" (*Annals of Botany*, Vol. VIII., 1894, p. 343) he made a contribution to morphology which at once marshaled the floral and foliage structures of higher plants in accordance with the doctrine of evolution, and destroyed the time-honored theory of the metamorphosis of foliage leaves into the perianth and essential organs of the flower. In the light of this theory the origin of the flower is no longer the hazy, although plausible impossibility of the older text-books. That he swept away along with much accompanying rubbish, and in its place gave us an explanation which has the double merit of agreeing with observed facts, as well as being biologically possible. Now the author who gave us a rational theory of the origin of the flower appears with a volume devoted to the origin of the terrestrial habit in plants, or as he puts it in the title of his book—the origin of a land flora—and we may predict for this

later theory a history equally successful with the former.

The volume consists of forty-seven chapters, divided into three parts, the first (of twenty chapters) being devoted to a "statement of the working hypothesis," the second (of twenty chapters, also) including a "detailed statement of facts," and the third (of seven chapters) devoted to "conclusions." Starting with the accepted doctrine of biologists that animal and plant life originated in the water, he shows that it is the sporophyte generation which becomes terrestrial, while the gametophyte is wholly aquatic, or at best still greatly dependent upon an abundant supply of water. His statement (p. 244) is so clear that we quote it here verbatim: "In respect to their whole life-cycle the *Archegoniatae* may be said to show an amphibial existence, the aquatic and the terrestrial characters being reflected in its two alternating phases. The gametophyte is as a rule delicate in texture, without intercellular spaces in its tissues, or a fully developed water-conducting system, while its sexual organs only become functional on their rupture in water outside the plant-body: the gametophyte thus proclaims its ultimate dependence on external fluid water as thoroughly as an alga. The sporophyte, on the other hand, is a characteristically sub-aerial body; this is shown by its more robust habit, its effective ventilating system, and its vascular strands for the conducting function seen in the higher forms: its final result, the maturing and dissemination of spores, is normally carried out under circumstances of dryness. All these features mark it as an essentially terrestrial phase."

In Chapter V. the author discusses the cytological differences between the gametophyte and sporophyte first distinctly pointed out by Strasburger in 1894, accepting chromosome-reduction as marking the end of the sporophyte generation and the beginning of the gametophyte, and chromosome-doubling as the end of the gametophyte generation and beginning of the sporophyte. By applying this test the beginnings of an alternation of generations may be recognized cytologically in the

vegetable kingdom long before it becomes obvious morphologically.

In the final chapter, which is entitled "Results, Phyletic and Morphological," some of the conclusions may be quoted, as "Both Mosses and Liverworts may with probability be held to be blind branches of descent, which illustrate nevertheless phyletic progressions that illuminate the origin of sterile tissues from those potentially fertile, and the establishment of a self-nourishing system in the sporophyte." "The phyletic relationship of the *Sphenophyllales* and *Equisetales* has undoubtedly been a very close one; the distinguishing features are not to be found in the primary plan or construction of the shoot, so much as in the secondary modifications of number and relation of the appendages, and of their branching, together with changes in the originally protostelic structure of the axis. Such considerations support the conclusion that the Sporangiophoric Pteridophytes constitute a brush of naturally related phyletic lines." "The Filicales appear as the most divergent phylum of homosporous Pteridophytes." Speaking of the vegetative system of the sporophyte in higher plants the author says: "Taking an evolutionary course of its own it diverged more and more in character from the propagative system. The final result is seen in the Angiosperms which are now dominant: here the flowers differ widely from the vegetative shoots, though the plan of each resembles that of the primitive shoot from which both sprang. But whatever the modern complications may be, comparison along lines which have been pursued in this volume indicates that the sporophyte, which is the essential feature in the flora of the land, is referable back in its origin to post-sexual complications: it appears to have originated as a phase interpolated between the events of chromosome-doubling and chromosome-reduction in the primitive life-cycle of plants of aquatic habit."

It merely remains to say that the publishers have brought out the book in a style befitting its importance—paper, type, presswork and illustrations, all being good and pleasing to the eye. The illustrations, of which there are

361, are plain, and while no attempt has been made to secure artistic effect, they do what they were intended to accomplish—namely, they help to explain the subject-matter. It is in all ways a thoroughly satisfactory book.

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Monographie des Onychophores. By E. L. BOUVIER. Extracted from *Annales de Sciences Naturelles, Zoologie* (1907), pp. 383 + 318, Pls. XIII.

The splendid monograph of the Prototracheata recently published by Professor Bouvier of the Paris Museum deserves a rather extended notice, because of the great interest attaching to the group of which it treats, and the fact that the work, owing to its place of publication, is very little known to American naturalists. A most interesting preface is headed by an appropriate motto, taken from Albert Gaudry: "Vieux habitants de la terre, apprenez-nous d' où vous êtes venus." A section follows, containing a general account of the morphology of the animals, with no less than 44 new and admirable text-figures. The bulk of the book is, of course, occupied with the detailed descriptions of the genera and species, while at the end are a complete bibliography and a check list. Everything is worked out in the most complete manner possible, and the history of each species is fully narrated; in its careful attention to detail and arrangement, the monograph may be classed with Scudder's great work on the butterflies of New England and Taylor's "Monograph of the British Land and Freshwater Mollusca."

The history of the classification of the Prototracheata is interesting. Up to 1894, all the known species were referred to the genus *Peripatus*, but in that year Pocock, in spite of opposition, recognized three genera, two proposed by him as new. This was thought revolutionary at the time; but to-day Professor Bouvier describes two families and seven genera, with excellent characters! The number of species has been increased from a mere handful to fifty, nineteen of them described by Professor Bouvier. The group remains as